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ABSTRACT

This paper examines those aspects of qualitative and quantitative research that might reasonably count towards effective educational research. The problem is addressed by examining their philosophical differences, their pursuit of objectivity, their approach to values, and the pursuit of reliability and validity. The possibility of rapproachment between qualitative and quantitative research is considered. The major assumptions in choosing an effective research methodology are discussed. It is concluded that educational researchers must take into consideration the respective characteristics of both qualitative and quantitative research in order to develop an optimal design for the particular problem. The optimal design may use qualitative or quantitative methodologies, or a combination of the two. Ultimately, either type of methodology must effectively address the problem at hand, must contribute to the field of knowledge, and must be both reliable and valid. (Author/JAZ)

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What Aspects of Qualitative and Quantitative Research Might Reasonably Count Towards Effective Educational Research

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Abstract

This paper examines those aspects of qualitative and quantitative research that might reasonably count towards effective educational research. The problem is addressed by examining their philosophical differences, their pursuit of objectivity, their approach to values, and the pursuit of reliability and validity. The possibility of rapproachment between qualitative and quantitative research is considered. It is concluded that educational researchers must take into consideration the respective characteristics of both qualitative and quantitative research in order to develop an optimal design for the particular problem. The optimal design may use qualitative or quantitative methodologies, or a combination of the two. Ultimately, either type of methodology must effectively address the problem at hand, must contribute to the field of knowledge, and must be both reliable and valid.

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WHAT ASPECTS OF QUALITATIVE AND QUANTITATIVE RESEARCH MIGHT REASONABLY COUNT TOWARDS EFFECTIVE EDUCATIONAL RESEARCH

This paper will attempt to examine those aspects of qualitative and quantitative research that might reasonably count towards effective educational research. The problem will be addressed by examining their philosophical differences, their pursuit of objectivity, their approach to values, and their pursuit of reliability and validity. The possibility of rapprochement between qualitative and quantitative research will be considered.

Before proceeding with the topics in question, it would be helpful to define several of the more frequently used terms. All definitions are excerpted from the Dictionary of Education, which was prepared under the auspices of Phi Delta Kappa, the professional fraternity in education.

Quantitative research: Research involving "the act or process of assigning, either arbitrarily or rationally, numerical values to observations that are commonly qualitative . . . differences in amount rather than kind."[1]

Qualitative research: Research involving " . . . differences in attributes rather than by numerical differences; differing in kind rather than amount."[2]

Objectivity: "A criteron for reliable knowledge

calling for the exhibition of the evidence so that the knowledge claim can be verified by other competent inquirers; . . . the rigorous exclusion of the desires, hopes, and fears of men in the interest of knowing the nature to their meaning for or bearing on other human purposes, . . . "[3]

Subjectivity: " . . . The quality of dependence on judgement, personal opinion, or bias, rather than on impersonal factual evidence; . . . the philosophical doctrine that truth should be sought and tested by inner consciousness, conviction or intuition of each individual, instead of by some objective criteron, . . . "[4]

Values: "Any characteristic deemed important because of psychological, social, moral, or aesthetic considerations; . . . "[5]

Qualitative and Quantitative Research: Philosophical Differences

Much of the current debate regarding the relative merits of qualitative and quantitative research stems from a basic philosophical difference. For the sake of argument and in the interest of simplicity, the systems of thought will be divided into two broad categories: Idealism and Realism.

Idealism is " . . . any system of thought or

practical view of emphasizing mind or spiritual reality as a preeminent principle of explanation; 'the conclusion . . . that the enduring substance of the world is of the nature of mind, that the material is explained by the mental, in contrast to all those systems of thought that center in nature, . . . "[6]

Realism is " . . . the doctrine that the object of knowledge is distinct from the process of knowing, exists independently of it, and that its true nature and properties are not constituted or affected by its being known . . . the belief that natural science progressively discloses the true nature of an independent physical world, . . . "[7]

Smith (1983) remarked that from a realist point of view, objects of educational research that do not exist materially, such as aptitude or motivation, can be studied scientifically in much the same manner as physical scientists can study sub-atomic particles as objects which as have not been actually seen but are assumed to exist "out there." Thus the realist position contends that human and social reality can exist "out there" independently of our minds as a subject-object relationship.

The idealist point of view proceeds from what we know to an "outer" reality (subject-subject). For idealists, there is no dualism of mind and reality, since reality is context-bound. On the other hand, realists tend to assume

that reality exists "out there," and that persons can fit into that reality, and that one can know how persons can come to know that reality.

For Smith (1983), whether one proceeds as an idealist or as a realist will in fact, " . . . influence how the research process is conceived and actually conducted. The idea that the process of investigation can be separated from what is being investigated, an idea crucial to the scientific process, is possible only within a realist perspective. . . . For idealists the opposite is true: The mind involvement of a constituted reality, and hence the impossibility of its existence as an independent reality, means that the process of investigation itself will affect what is being investigated."[8]

Central to the quantitative position is that "truth," which springs from a reality independent of the mind, can be empirically verified. The quantitative researcher denies this correspondence between mind and reality which negates the possibility of empirical verification. To the quantitative researcher competing claims to reality can be arbitrated by the scientific method in which reality is observed, experimentally acted upon, and tested for significance. According to Smith (1983), the qualitative researcher handles competing claims to reality by having participants come to an "agreement," that is very much tied

to values and interests.

Wilson (1977) found limitations in the natural science model that quantitative researchers employ. He believed " . . . that the social sciences cannot understand human behavior without understanding the framework within which the subjects interpret their thoughts, feelings, and actions."[9] (Emphasis in the original.)

The major feature of qualitative research, according to Wilson (1977) is that it allows one to fully understand human behavior by studying it in its naturalistic background. To do otherwise, he thought, would negate the forces under which the behavior occurred. And he suggested that human behavior consisted of both manifest and latent meanings that are not captured by simply observing "facts."

In brief, the quantitative researcher believes that empirically verifiable "truth" statements or generalizations can be made that are "context-free." The qualitative researcher at best hopes to make "working hypotheses" that are true within a given context (Smith, 1983; Guba, 1981).

Qualitative and Quantitative Research: The Pursuit of Objectivity

Rist (1977) observed: "Quantitative research is the dominant methodology in educational research. It is more widely published, taught, accepted, and rewarded in

educational research circles than any other approach."[10] It has traditionally had several characteristics attributed to it: "removed from the data," "objective," and "controlled measurement" (Reichardt and Cook, 1979). Recently questions have arisen about the accuracy of those descriptions.

Perhaps one reason for the popularity of quantitative research is the "mystique of quantity" (Kaplan, 1964). The mystique refers to a heightened regard for the power of quantification without regard to what is being quantified or what will ultimately be done with the quantification. In short, the number is treated as having its own scientific value.

Carr (1983) argued that educational research has actively courted quantitative methods because its findings appeared to be based on "neutral" evidence rather than subjective evidence. He further remarked that the appearance has been given that " . . . subjective bias can be expunged from educational research and the goal of creating a scientifically validated body of 'value-free' educational theory pursued in an atmosphere undisturbed by the clash of rival interpretations and subjective prejudices. . . "[11]

Morgan (1983) viewed quantitative research as an engagement in interaction between the researcher and the object of study. What the researcher observes is directly related to the nature of that engagement. In other words,

it is the observer, the protocol, and the operational technique that provide objectivity to the object, not the object itself.

In this regard Morgan (1983) questioned the very possibility of objective research. He stated that since there is an interaction between observed and observer, and since both are part of the larger whole, it might be impossible to stand outside the research process and evaluate it the way quantitative research is often portrayed.

In short, Morgan (1983) saw the research process more as a conversation between observed and observer, than a monologue. "As soon as we entertain the idea that what the 'Eye of the Mind' sees in the external world may be as much a consequence of the nature of the eye as it is of the object seen, we create severe problems for the view that the 'truth claims' of the scientific theories can be judged in terms of a criteron of objective knowledge based on an ability to mirror or reflect the nature of the external world."[12]

Objectivity or fallibility rate as defined by Howe (1985), is the inner-subjective agreement, or the degree to which observers of different backgrounds allow those differences to play a part in their assessment of a situation. Howe pointed out that although the quantitative researchers have traditionally been thought to have greater objectivity

or a lower fallibility rate than qualitative researchers, "the essential point is that this case cannot be generalized; just the opposite ordering of fallibility between quantitative and qualitative data is possible and indeed common."[13]

The fact that qualitative researchers do not standardize the subjects' responses, as do their quantitative counterparts, was not found by Wilson (1977) to dictate that participant observation (typically an ingredient of qualitative research) need be subjective. He suggested that a "disciplined subjectivity" is used in qualitative research that is intrinsically as objective as that used in quantitative research.

Sax (1986) believed that if properly identified and described, subjectivity has its place in quantitative research. But he further stated that subjectivity in the selection of a topic for study is not equivalent to bias, which he refers to as the " . . . wanton disregard of evidence or the creation of convenient but untrue propositions."[14]

Qualitative and Quantitative Research: Their Approach to Values

There is not a universal belief that educational research, in fact, can separate the context of discovery wherein the subjective values determine what is to be

hypothesized, from the logic of confirmation wherein values are kept from the validation of the hypothesis (Carr, 1985).

Kaplan (1964) suggested that since values can not be excluded from educational research, it is best to ground them objectively and realize that they are a part of the research. But Kaplan noted that values are not necessarily biases; a bias implies that one's values are kept away from the test of experience.

To the qualitative researcher, quantitative research is perhaps unrealistic inasmuch as society, history, and personal values dictate what we study, and how we study it. The quantitative researcher does not dismiss the existence of values. Rather, he or she limits its presence to deciding the particular line of inquiry to be studied (context of discovery), afterwhich the quantitative research takes over. The qualitative researcher does not believe that one can readily "switch hats" from values to facts (Smith, 1983).

It has been suggested by Carr (1985) that educational philosophy has "explicitly" presented metaphysical theories of human nature. Such metaphysical theories, which contain a conception of educational values, are also "implicitly" present in educational research. Thus to Carr, educational research has embraced values which are

reflective of the metaphysical theory of human nature on which it is based.

Howe (1985) believed that "fact-value distinction" is a dogma of educational research. In the 24 years since Quine wrote "Two Dogmas of Empiricism" (in From a Logical Point of View), which Howe described as very critical of positivism (defined by Howe as the belief that social problems can be studied scientifically), post-positivism thought has sprung forth. "Ultimate, theory-free, factual knowledge cannot exist, and positivism's corollary fact-value distinction is untenable. . . the distinction between description and evaluation depends on the uses to which concepts are put."[15] Howe found that social research is particularly laden with values since values determine findings and the use of research results. Social researchers tend to evaluate not just describe human behavior.

In attempting to unravel the myriad of complex interactions that are present in educational research, perhaps Ericson and Ellett (1982), expressed it most clearly: "No matter how perfectly shared an understanding of a particular social practice is, various interpretations will abound concerning what is essential and what is dispensable to its existence."[16] In other words, in an attempt to describe all that is meaningful, researchers have to open themselves to a multitude of interpretations,

or points of view (values).

Qualitative and Quantitative Research: The Pursuit of Reliability and Validity

A common complaint about qualitative and quantitative research is that it occasionally is deficient in reliability and validity. Reliability is " . . . worthiness of dependence or trust; . . . the accuracy with which a measuring device measures something; the degree to which a test or other instrument of evaluation measures stably or consistently whatever it does in fact measure; . . . "[17] Validity is " . . . the quality of being grounded on truth or fact; . . . the extent to which a test or other measuring instrument fulfills the purpose for which it is used; . . . "[18]

Reliability can present a "hurculean problem" for qualitative researchers, due to the nature of the data and research process, the manner of presenting the finds, and the ways that qualitative researchers are traditionally trained (leCompte and Goetz, 1982; Rist, 1977).

However, regarding validity, LeCompte and Goetz (1982) found: "Although the problems of reliability threaten the credibility of much ethnographic work, validity may be its major strength. This becomes evident when ethnography is compared to survey studies, experi-

mentation, and other quantitative research designs . . ."[19] The authors attributed this to the researchers' common practice of living with the participants and collecting long-term data which is constantly refined and to conducting the research in a naturalistic setting that is perhaps more reflective of reality.

In an attempt to assess the "trustworthiness" of the data, Guba and Lincoln (1982) have proposed four major areas into which any research must address itself: (1) truth value (how well do the observations match the realities under study; (2) applicability to other contexts or with other subjects; (3) consistency with which the findings can be replicated in the same or a similar context; and, (4) the neutrality of the findings (have the observer's biases or interests influenced the findings?).

In quantitative research these terms are typically referred to as (1) internal validity, (2) external validity, (3) reliability, and (4) objectivity. Guba and Lincoln (1982) believed that qualitative research has four analogous terms for the same concepts: (1) credibility, (2) transferability, (3) dependability, and (4) confirmability.

Guba and Lincoln do caution however, "It is premature to expect that adherents of the naturalistic paradigm would have evolved as sophisticated a methodology for dealing with rigor and trustworthiness questions as their rationalistic

counterparts, especially since the latter have had literally centuries to work on refinements."[20]

Although one can imagine analogous counterparts in qualitative research that address the problems of reliability and validity, Guba (1981) pointed out that a qualitative study can not be judged by quantitative standards. He felt that it would be unjustified to label as unacceptable a qualitative study because it lacked controls, randomization, replicability, and investigative objectivity.

In a similar view, Morgan (1983) stated that the quantitative researcher's goal of systematic, replicable, objective observation and measurement are often applied to qualitative research with a subsequent disparagement of the research. Morgan noted that although quantitative methodology works within its framework, it can not be reasonably applied to qualitative research.

Qualitative and Quantitative Research: Rapprochement at Last?

Unlike natural science, educational research must not pursue a monolithic form of research in which only qualitative or quantitative research is performed. Carr (1985) equated that openmindedness with the prevention of the suppression of disagreement about educational values.

Reichardt and Cook (1979) also recommended that

educational research drop the qualitative and quantitative labels, which encourage polarization, and called for a combination of the methods.

The inextricability of qualitative and quantitative methods was also observed by Kaplan (1964) who commented: "The point is that both quality and quantity are misconceived when they are taken to be antithetical or even alternative. Quantities are of qualities, and a measured quality has just the magnitude expressed in its measure."[21]

The claims made by both "sides" are viewed by Morgan (1983) to be largely self-justified; their arguments are based on their own assumptions. The quantitatives claim that data must be rid of subjectivity and the qualitatives claim that subjective reality is important since it is the center of knowing the object; both can be justified by their methodologies.

Morgan (1983) favored different approaches for different problems, noting that either research alone would be insufficient: "Interpretive social science certainly offers a brand of insight that positivism can not achieve, but on the other hand, positivism can also generate forms of knowledge that elude the interpretive approach."[22]

In its current stage, the qualitative-quantitative debate has replaced "mutual disdain" with compatibility and cooperation. In its previous (transitional) stage, detente

presided over a moderation of paradigmatic differences. And in its initial stage, which lasted until recently, both "sides" claimed fundamental and irresolvable differences in procedures and assumptions (Smith and Heshusius, 1986).

By taking the viewpoint of the objective outsider, the quantitative researcher generally fails to take the participant's perspective and works within a perhaps, ill-conceived framework wherein the hypothesis and categories for study are prespecified (Wilson, 1977).

The earlier proponents of qualitative research such as Dilthey, Husserl, and Weber proposed that the best explanations of phenomena might come from "within." In this sense, Morgan (1983) saw the earliest examples of qualitative research to be an attempt to counter the limitations of quantitative methods.

The methodology of quantitative research has been refined for the last 140-plus years. Smith and Hamilton (1980) argued that many of the methods and techniques of quantitative research stem from John Stuart Mill's, A System of Logic, published in 1843. Mill's beliefs had a formative influence on many of modern quantitative techniques such as regression, analysis of variance, and random sampling. Although these techniques were associated with persons such as Karl Pearson, R.A. Fisher, and Edward Thorndike, Smith and Hamilton believe that Mill laid the theoretical background

for what was to become quantitative research.

Ericson and Ellett (1982) suggested that qualitative research began to gain greatly in popularity with the demise of behaviorism, which they defined as the view of human actions as the mere study of human behavior (conditioned responses). Behaviorism did not take into account actions, beliefs, purposes or emotions of the respondents. Once researchers began to see the shortcomings of behaviorism, qualitative research became the major tool for hypothesis formation or the context of discovery; and quantitative research provided the means for hypothesis testing or the logic of confirmation.

In recent years there has been a shift by neo-positivists towards a more context-embedded, more qualitative or interpretive type of research (Miles and Huberman, 1984). The authors also have found that neo-idealists have drifted towards a more systematic inferential approach in order to establish construct validity (the degree of match between the observations and a theoretical concept).

"From the positivistic end, we should note that it is typical for the hardest of hypothetico-deductive noses to engage in inductive sniffing in data sets; . . . We might also note that many qualitative researchers are turning to more systematic methods of storage, retrieval, and analysis with the aid of micro-computers [sic]; . . . Idealists can

be structured, and realists can be loose."[23]

Smith and Heshusius (1986) believed that the qualitative--quantitative debate has been helpful in that it has forced the qualitative researcher to examine criteria or procedures that they might employ to control subjectivity and to allow verification. The authors found that both approaches have the same goals and are interpreted in the same manner, differing only in their practices.

"Both perspectives are now thought of--even if only implicitly--as sharing the same realist-oriented assumptions. . . . Many educational researchers have taken the unfortunate conclusion that there are no longer any significant differences between the two perspectives."[24]

LeCompte and Goetz (1982) suggested that the thought of distinct qualitative and quantitative "camps" was "unecessary, inaccurate, and ultimately counterproductive." They stated that educational research has produced many good studies which have incorporated qualitative and quantitative strategies.

An integration of qualitative and quantitative perspectives was envisioned by Wilson (1977) and Howe (1985). Commenting upon the recent interest in qualitative research, Wilson stated: "The methodology of ethnographic researchers is as rigorous and systematic as that of other researchers. It is a vital and viable tradition which is constantly in

the process of being evaluated and refined . . . The techniques . . . can be coordinated with other methods into an excellent research design that could elicit information not accessible to researchers using more quantitative techniques."[25]

Commenting upon the attempt by some researchers to divide research into qualitative and quantitative, Sax (1986) wrote that it is " . . . both unnecessary and wrong--unnecessary because the topics studied by the 'qualitative' researcher were also being investigated by the 'quantitative' researcher--and wrong because the distinction between the qualitative and quantitative are part of the same enterprise and require no rigid distinctions."[26]

Qualitative and Quantitative Research: What Counts as Effective Research

If one accepts that qualitative and quantitative paradigms differ on major assumptions such as the nature of reality, the nature of the inquirer-object relationahip, and the nature of "truth statements" (Smith, 1983; Guba, 1981) does that bind the researcher to the methodology to be employed? Guba (1981) answered with a resounding, "No!" Guba stated that the question for research is "What paradigm best suits the study?" He saw no reason, moreover, why

researchers operating within the qualitative paradigm could not use quantitative methods, and why researchers operating within the quantitative paradigm could not use qualitative methods.

The paramount question for educational research according to Smith (1983) is the epistemological question, "What is to count as knowledge?" He recommended that researchers discuss the question. To do otherwise, " . . . they are forfeiting any participation in determining the bases for the authority of their knowledge."[27] It was not yet clear to Smith whether there should be one approach to deciding what is good or bad qualitative research and another approach to deciding what is good or bad quantitative research.

A combination of qualitative and quantitative methods was suggested by Howe (1985), who concluded: "The merit of a given piece of research depends on how it responds to the fallibility of the question at issue [objectivity], the fallibilities of relevant background beliefs, [and] the nature of the question, . . . "[28] The final criteron of effective research then becomes, "Is there reason to doubt what the researcher claims to have found?"

Howe (1985) further remarked that educational research can be criticized for moral reasons internal to

the study, such as did the researcher submit the subject to unnecessary pain or risk, and from social utility reasons external to the study, such as does the study effectively contribute to the field of knowledge. The last point, that of social utility, emphasized that educational research must have a conscious link to educational goals.

Rist (1977) has suggested that although one methodological approach to research might be the ideal, it is important that educational researchers be able to employ whatever methodology answers the question of for whom and for what reasons the research is being done.

Conclusion

Since much of the debate over the merits of qualitative and quanitative research stems from their philosophical differences which are deterministic in defining their pursuit and approach to aspects such as objectivity, reliability, validity, and values, we should perhaps look to philosophy for the resolution.

Perhaps "truth" lies in the supposition that there is no mutual exclusions between Idealism and Realism. Maybe both systems of thought are "true" descriptions of reality. Physics has found that long-held dualisms have disappeared under investigation. Mass and energy, thought

of as distinct, were discovered to be convertible, and light can act as both wave and particle (Pagels, 1982).

Perhaps reality is subjective: Objects are a reflection of the mind, and reality is objective: Objects are distinct and independent from the mind. The discovery of the indeterminate nature of the universe by quantum physics (the study of the structure of the atom) revolutionized the deterministic view of natural science held by scientists since Newton postulated it in the early eighteenth century.

Pagels (1982) stated that physicists have learned more about the structure of matter in the last 15 years than in previous centuries. The quantum world, recently discovered, includes a lack of objectivity, indeterminacy, and observer-created reality.

Pagels wrote: "According to quantum theory, some events such as electrons jumping around atoms occur at random. There just isn't a physical law that will ever tell us when an electron is going to jump; . . . They found that . . . what an observer decides to measure influences the measurement . . . reality is partially created by the observer."[29]

Educational researchers must take into consideration all aspects of qualitative and quantitative research in order to develop a design for the particular and unique

reality of the problem. The effectiveness of educational research, whatever the philosophical stance regarding objectivity and values or methodology chosen, lies in its outcome. Did the research methodology utilized effectively address the problem? Are the findings reliable and valid? And did the research add to the field of knowledge or help to resolve the problem it set out to address?

Educational research is fortunate that both qualitative and quantitative methodologies exist within its realm. Each methodology contributes to the puzzle. Quantitative methodology brings the possibility of objectivity, prediction, and precision. Qualitative methodology brings the possibility of a naturalistic setting, empathy, and freeness. The beauty of educational research is that it is free to choose the best aspects of either methodology as necessary to address the study at hand. And to the extent it keeps that openmindedness, educational research has truly gained.

Footnotes

[1]C.V. Good (ed.), Dictionary of Education (New York: McGraw-Hill Book Co., 1959), p. 434.

[2]Ibid., p. 434.

[3]Ibid., p. 372.

[4]Ibid., p. 535.

[5]Ibid., p. 593.

[6]Ibid., p. 278.

[7]Ibid., p. 446.

[8]J.K. Smith, "Quantitative Versus Qualitative Research: An Attempt to Clarify the Issue," Educational Researcher, XII, No. 3(March, 1983), p. 9.

[9]Stephen Wilson, "The Use of Ethnographic Techniques in Educational Research," Review of Educational Research, XLVII, No. 1(Winter, 1977), p. 249.

[10]R.C. Rist, "On the Relations Among Educational Research Paradigms: From Disdain to Detente," Anthropology and Educational Quarterly, VIII, No. 1(Spring, 1977), p. 42.

[11]Wilfred Carr, "Can Educational Research be Scientific?" Journal of Philosophy of Education, XVII, No. 1(July, 1983), p. 40.

[12]Gareth Morgan, "Towards a More Reflective Social Science," Beyond Method: Strategies for Social Research, ed. Gareth Morgan (Beverly Hills: Sage Publications, 1983), p. 371.

[13]K.R. Howe, "Two Dogmas of Educational Research," Educational Researcher, XIV, No. 8(October, 1983), p. 14.

[14]Gilbert Sax, "The Ethics of Quantification and Why It Doesn't Work or Life Among the Numerologists, Inumerates, and Qualitatives." Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, April 16-20, 1986, p. 5.

[15]Howe, op.cit., p. 11-12.

[16]D. P. Ericson and F. S. Ellett, Jr., "Interpretation, Understanding, and Educational Research," Teachers College Record, LXXXIII, No. 4(Summer, 1982), p. 509.

[17]Good, op.cit., p. 593.

[18]Good, op.cit., p. 253.

[19]M. D. LeCompte and J. P. Goetz, "Problems of Reliability and Validity in Ethnographic Research," Review of Educational Research, LII, No. 1(Spring, 1982), p. 43.

[20]E. G. Guba and Y. S. Lincoln, "Epistemological and Methodological Bases of Naturalistic Inquiry," Educational Communication and Technology Journal, XXX, No. 4(Winter, 1982), p. 297.

[21]Abraham Kaplan, The Conduct of Inquiry(San Francisco: Chandler Publishing, 1964), p. 207.

[22]Gareth Morgan, "Exploring Choice: Reframing the Process of Evaluation," Beyond Method: Strategies for Social Research, ed. Gareth Morgan(Beverly Hills: Sage Publications, 1983), p. 397.

[23]M. B. Miles and A. M. Huberman, "Drawing Valid Meaning from Qualitative Data: Toward a Shared Craft," Educational Researcher, XIII, No. 5(May, 1984), p. 21.

[24]J. K. Smith and L. Heshusius, "Closing Down the Conversation: The End of the Quantitative--Qualitative Debate Among Educational Inquirers," Educational Researcher, XV, No. 1(January, 1986), p. 10.

[25]Wilson, op.cit., p. 261.

[26]Sax, op.cit., p. 1-2.

[27]Smith, op.cit., p. 13.

[28]Howe, op.cit., p. 17.

[29]Heinz R. Pagels, The Cosmic Code: Quantum Physics as the Language of Nature(New York: Bantam Books, 1982), p. 47.

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